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## SOME ADDITIONAL DATA ON THE POSITION OF THE SACRUM IN NECTURUS.

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THREE papers<sup>1</sup> which deal incidentally with the position of the sacrum in *Necturus maculosus* Raf. have appeared within recent years, in each of which are mentioned several instances of variation from the typical symmetrical sacrum on the nineteenth vertebra, and they record observations on 158 specimens. The use of *N. maculosus* as an object of study in some of the zoölogical classes of the University of Illinois has made it easy to accumulate additional information on the position of the sacrum in this species, and since data of this kind have a recognized value, and since certain variations from the normal condition have been found which have not been previously reported, it seems worth while to publish a brief account of the relations of the sacrum in the 114 specimens which have been examined in our laboratories. The material was all obtained from Lake Erie, near Sandusky, Ohio, during the years 1897-99.

Table I presents in a convenient form the data from the above-mentioned specimens, but as thirty-two of them were not examined for the position of the first hæmal arch they are tabulated in a separate column.

For convenience in a comparison of the various observations mentioned, Table II has been prepared. It relates to 241 specimens — the 158 specimens previously recorded, the eighty-two specimens listed in Table I, in which the position of the first hæmal arch is known, and one other specimen listed in that

<sup>1</sup> Parker, G. H. Variations in the Vertebral Column of *Necturus*, *Anat. Anzeiger*, Bd. xi, pp. 711-717.

Bumpus, H. C. A Contribution to the Study of Variation (Skeletal Variations of *Necturus maculatus* Raf.), *Journ. of Morph.*, vol. xii, pp. 455-484, 3 pls.

Waite, F. C. Variations in the Brachial and Lumbro-Sacral Plexi of *Necturus maculosus* Raf., *Bull. Mus. Comp. Zool.*, vol. xxxi, No. 4, pp. 71-92, 2 pls.

table, in which the position of the first hæmal arch is unknown, but which has three sacral ribs.

TABLE I.<sup>1</sup>

VERTEBRA WHICH CARRIES SACRUM.	NUMBER OF SPECIMENS.	FIRST HÆMAL ARCH ON			
		<i>Vertebra 22.</i>	<i>Vertebra 23.</i>	<i>Vertebra 24.</i>	<i>Vertebra 25.</i>
XIX . . . . .	81	30	33		18
XX . . . . .	16		4	2	10
XXI . . . . .	1			1	
R. XVIII . . . .	2	2			
L. XIX . . . . .					
R. XIX . . . . .	1	1			
L. XVIII . . . .					
R. XIX . . . . .	3		3		
L. XX . . . . .					
R. XX . . . . .	6		2	1	3
L. XIX . . . . .					
R. XVIII . . . .	1	1			
L. XVIII, XIX					
R. XIX . . . . .	2		1		1
L. XIX, XX . . .					
R. XIX, XX . . .	1		1		
L. XIX . . . . .					
Total . . . . .	114	34 = 41 % of 82	44 = 54 % of 82	4 = 5 % of 82	32

Some of the data listed in the above tables deserve further mention. One of the most striking points is the occurrence of as many as five individuals having three sacral ribs. Waite mentions one such instance, which I think is the only one previously recorded for *N. maculosus*, while among the 114 individuals examined by us there are four such cases. One of these has, as an additional peculiarity, two sacral ribs on the eighteenth vertebra, and is the first one recorded in which that vertebra is invaded on both sides. The figure shown on p. 638 represents the eighteenth, nineteenth, and twentieth vertebrae

<sup>1</sup> R. and L. are used as abbreviations for right and left.

TABLE II.<sup>1</sup>

CHARACTER AND POSITION OF SACRUM.	NO. OF SPECIMENS RECORDED BY			241 SPECIMENS.
	<i>Parker.</i>	<i>Bumpus.</i>	<i>Waite.</i>	
<i>Symmetrical.</i>				
XIX — 22 . . . . .	4	10	10	54
XIX — 23 . . . . .	15	52	10	110
XIX — 24 . . . . .		2		2
XX — 22 . . . . .		1		1
XX — 23 . . . . .	6	24	7	41
XX — 24 . . . . .		3		5
XXI — 24 . . . . .				1
<i>Asymmetrical.</i>				
R. XVIII, L. XIX — 22 . . . . .		1	2	5
R. XIX, L. XVIII — 22 . . . . .				1
R. XIX, L. XX — 23 . . . . .			1	4
R. XX, L. XIX — 23 . . . . .	1	7		10
R. XX, L. XIX — 24 . . . . .				1
R. XXI, L. XX — 24 . . . . .	1			1
R. XVIII, L. XVIII, XIX — 22 .				1
R. XIX, XX, L. XIX — 23 . . . .			1 <sup>2</sup>	2
R. XIX, L. XIX, XX — 23 . . . .				2 <sup>3</sup>

with the sacral ribs and ilia from the dorsal side. The dotted lines indicate the outlines of the cartilage and other tissue forming the articulations between the ilia and sacral ribs, as

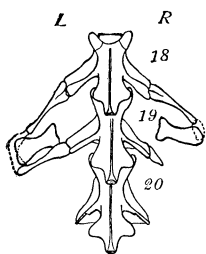
<sup>1</sup> The Arabic numerals are used to designate the vertebra bearing the first hæmal arch.

<sup>2</sup> The position of the first hæmal arch of this specimen is not recorded.

<sup>3</sup> The position of the first hæmal arch in one of these specimens is unknown.

seen in the dried skeleton. The two sacral ribs on the left side are about equal in size and share alike in the support of the ilium.

The other four specimens having three sacral ribs, listed in Table II, each have paired sacral ribs on the nineteenth vertebra, while the unpaired sacral rib is borne on the right side of



the twentieth vertebra in two of them, and on the left side in the other two. Twenty-five specimens are listed which have an asymmetrical sacrum with but two sacral ribs, and in nine of these the sacral rib of the right side is further cephalad, while in the remaining sixteen it is the left sacral rib which is in advance. It seems curious that

in the first ten specimens which were reported as having this condition of the sacrum, nine should have had the left side in advance, while in the next fifteen over half of them should have the right side in advance; and again it is singular that, of six specimens in which the eighteenth vertebra is invaded, five of them should have the right side in advance, while in the remaining nineteen cases fifteen should have the left side in advance. It is evident that data from a much larger number of specimens must be obtained before trustworthy generalization can be made.

One individual found during the past winter and listed above has a symmetrical sacrum on the twenty-first vertebra, a condition not previously recorded, I believe; and in one specimen described by Parker this vertebra was invaded on the right side; but these two specimens are the only ones, so far as I know, in which the twenty-first vertebra is invaded by the sacrum.

I am under obligations to Mr. Ralph G. Mills, a student at the University, for making the drawing for the figure, and also for the examination of a considerable number of the specimens studied.